PROGRESS OF THE BARBERRY ERADICATION CAMPAIGN IN INDIANA, 1928

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Introduction

Indiana farmers produce annually about 30,000,000 bushels of wheat, 65,000,000 bushels of oats, 2,000,000 bushels of rye, and 750,000 bushels of barley. These grains are subject to attacks of black stem rust which causes an average annual loss in Indiana of approximately 400,000 bushels. Obviously, any control measure which will reduce this enormous loss deserves the cooperation of every man, woman, and child in Indiana.

More than 250 years ago, farmers of Europe suspected that the common barberry was spreading black stem rust to their small grains. They noticed that rust was always heaviest near common barberry bushes. They knew what happened, but not why. It was not until 1865 that DeBary proved by scientific methods that the common barberry did carry and spread black stem rust. DeBary's results have been confirmed hundreds of times since then, so that the facts now are well known.

The idea of barberry eradication as a means of reducing stem-rust losses is not a new one. Campaigns to eradicate rust-spreading barberries have been carried on by many European countries in the last 200 years. As a result of these campaigns in Europe, positive local control has been effected, and, where eradication has been thorough, as in Denmark, stem rust has been controlled over the entire country. Laws were passed in Connecticut, Rhode Island, and Massachusetts before 1775 prohibiting the growing of common barberries. Stem rust was not controlled in these States because the laws were not rigidly enforced, but in localities where complete eradication was accomplished, beneficial results followed immediately upon removal of the barberries. Local attempts at eradication in other States resulted in decreased rust losses, but the widespread influence of adjacent barberries reduced the effectiveness of local eradication.

Necessity for the Present Barberry Eradication Campaign

As early as 1891 severe local attacks of stem rust had been known in the north-central grain-growing States, but previous to 1904 there had been no widespread and destructive epidemic of stem rust. The season of 1904 was characterized by an epidemic so severe and so widespread that it was of national importance. A general but less severe epidemic occurred in 1911, which brought about the realization that losses from stem rust, even in ordinary years, were large and important. In 1916 a great epidemic of black stem rust swept over the wheat-growing belt of the United States. As a result, the nation suffered an estimated loss of 200,000,000 bushels of wheat and correspondingly large losses of other

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cereals. This enormous loss of small grains at such a critical time commanded the attention of both the economists and the pathologists of this country. This disaster, along with authentic knowledge that barberry eradication had completely controlled black stem rust in Denmark, resulted in a campaign which was launched in the spring of 1918, by the United States Department of Agriculture in cooperation with the State Agricultural agencies of Colorado, Illinois, Indiana, Iowa, Michigan, Minnesota, Montana, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin, and Wyoming, to eradicate all the common barberry bushes growing within the boundaries of these States.

The Barberry Eradication Campaign in Indiana

Financing

As it is under Federal supervision, the barberry eradication campaign in Indiana is financed almost entirely by the Government. While no actual cash has been given to the campaign by the State of Indiana, splendid support and some very valuable indirect aid has been given by the cooperative agencies within the State. Since the beginning of the campaign in 1918, the total cost for finding and destroying 200,196 barberry bushes on 5,220 properties in Indiana has been less than 80 cents per farm.

Organization

The barberry eradication campaign in Indiana is directed by a State Leader who has a corps of field assistants, all under the general supervision of the Office of Cereal Crops and Diseases, Bureau of Plant Industry, United States Department of Agriculture, Washington, D. C., and who work in cooperation with the Purdue University Agricultural Experiment Station, Extension Department, School of Agriculture, and other State agencies. The Conference for the Prevention of Grain Rust, located at Minneapolis, Minnesota, which is composed of representatives of agricultural and allied interests, cooperates very closely with the campaign in this State.

The immediate success of the barberry eradication campaign depends to a very large degree upon the personnel of the organization, from the National Leader down to the newest scout. The field personnel molds the attitude of the public toward barberry eradication and, to a certain degree, the attitude toward the institutions which they represent, namely, the United States Department of Agriculture and the Purdue University Agricultural Experiment Station. With this in mind, every effort has been made to select, train, and put into the field only the highest type of men to prosecute the barberry eradication campaign.

Under the general supervision of the National Leader, the State Leader in Indiana supervises the following four phases of the campaign: Surveys, Eradication, Education and Publicity, and Investigations.

Survey for Barberries

Three types of survey have been used in finding barberries. These are the first or preliminary survey, the second survey, and the resurvey.

The first or preliminary survey was a property-to-property survey in cities, towns, and villages and a farm-to-farm survey of all rural properties in the State. The purpose of this survey was the destruction of the largest number of bushes in the shortest possible time. Every barberry destroyed lessens the chance of stem-rust infection. Therefore, at the beginning of the eradication campaign more emphasis was placed on destroying a large number of bushes than on getting every bush as the survey progressed. The first survey was completed in 1924.

The second survey in Indiana has been more intensive than was the preliminary survey. On this survey a thorough inspection is made of all farmsteads, including the house-yard, garden, orchard, barnyard, near-by fence rows, adjacent woods, and other such near-by places as may be expected to harbor barberries. Whenever barberries are found on this survey, a foot-by-foot survey is then made in every direction for at least two miles from the last bush found. The field agents on second survey locate not only the straggling bushes missed on the first survey, but also many new bushes which have grown from seeds scattered from the planted bushes by birds or other agencies. To date, six counties, Clinton, Howard, Tipton, Madison, Grant, and Hamilton, have been second-surveyed in Indiana.

Some one may ask if it would not have been better to have gone more slowly on the first survey and taken time to find every bush possible. Had that plan been followed, only a small portion of the State would have been covered yet, and all of the bushes in the unsurveyed portion would have been causing damage during all this time. As it was carried on, the greater portion of the bushes was found and eradicated within a few years. Naturally some bushes were missed on the first survey, and these are capable of doing some damage, but the chance of great damage was reduced materially in a few years by speeding up the work and covering the whole State.

A resurvey is a reinspection of a property on which barberries have previously been dug, treated with chemicals, or otherwise eradicated. These properties are resurveyed at regular intervals after the bushes have been eradicated, in order to look for and destroy sprouts and seedlings which may have grown from root fragments or seeds of the original bush. More than one resurvey is necessary for complete eradication, because sprouts and seedlings, especially seedlings, are difficult to locate when they are small. Also, barberry seeds may remain dormant for many years, then germinate and grow into vigorous seedling bushes. Resurveys must be frequent enough to prevent sprouts and seedlings from growing into

fruiting bushes, and continued until the danger from dormant seed has passed.

Eradication

During the early years of the barberry eradication campaign, it was learned that the common barberry is very difficult to kill by digging or pulling. Even small root fragments must not be left in the ground, as they are capable of producing sprouts. Poor digging is worse than no digging at all. It has been shown conclusively during the last six years that both salt and kerosene are very effective as killing agents for barberry bushes. The relatively few bushes not killed by the treatment of salt or kerosene were found to have been improperly treated or were treated with too small a quantity of the chemical. Care must be used in the application of either chemical. The base of every shoot must be treated. While the amount of either chemical necessary to kill a bush will vary according to the size of the bush, twenty-five pounds of salt or a gallon of kerosene poured into the crown of a bush twelve inches in diameter at the base will usually kill the bush.

Publicity and Education

The job of telling the barberry and stem-rust story to more than 3,000,000 people in Indiana is two-fold in nature. Some information must accompany the surveys to acquaint the public with the purpose and progress of the campaign. This is the publicity phase. Its purpose is to reach the public quickly and to secure immediate support and co-operation for the work. Materials designed to teach the public how to identify both the common barberry and stem rust are part of all publicity. Items of local interest are given local emphasis. Intensive use is made of news articles, lantern-slide series, exhibits, demonstrations, window displays, and roadside signs. Talks by the State Leader and the field men are made at local gatherings. Many of these talks are supplemented with lantern slides and small demonstrations. In 1928, every effort was made to improve the quality of publicity disseminated. Demonstrations were analyzed and improved. Newspaper articles were more carefully written and better illustrated. Bulletins, circulars, and colored plates were more judiciously distributed. As a result, the total amount of publicity accomplished during the year was slightly less than in some previous years, but its effectiveness was considerably increased, and more complete public cooperation was obtained.

The educational phase is designed to teach the children of the present and future generations how to recognize the common barberry so that they can carry on the work through a real knowledge of the cause of black stem rust and the damage that it does. This educational phase is being carried on through the schools and through children's organizations. The closest cooperation has been given by the State Superintendent of Public Instruction in Indiana. County superintendents of schools and local teachers are aiding in all of the counties in the State. Universities,

colleges, normal schools, and teachers' colleges are aiding by teaching their students, some of whom will be the teachers of to-morrow, to properly present this important scientific subject. Teachers in all of the schools are being furnished lesson plans, Federal and State bulletins and circulars, specimens of the common barberry and rusted straw, and such other materials as will aid them in teaching their pupils the story of stem rust and the common barberry.

The students are learning the real source of black stem rust and the characteristics of the common barberry. With this knowledge they will be able, in the future, not only to recognize and destroy common barberries but to prevent the re-establishment of these bushes in their communities. The educational phase also has some immediate results. Numbers of barberry plantings have been found and reported by school teachers and school children. Some of these plantings are so situated that they would not have been found for years by the field agents, and would have produced millions of seeds before being destroyed on the regular surveys.

Much of the credit for the effectiveness of the publicity and educational activities in 1928 is due to the cooperative agency, the Conference for the Prevention of Grain Rust, which has its headquarters at Minneapolis, Minnesota. Through the efforts of its Secretary, Mr. Donald G. Fletcher, this organization furnished a large part of the colored materials used in the publicity and educational work this year.

Investigations

In 1922, a single common barberry bush growing near Alert, in Decatur County, Indiana, spread stem rust over an area of about fifty square miles, causing a crop loss estimated at more than $50,000 in the one year. Annual inspections have revealed no stem-rust losses in this community since the offending common barberry was killed. About forty other cases have been found in Indiana where black stem rust has been directly traced to common barberries in the immediate vicinity.

Fortunately, in Indiana, stem rust does not develop into State-wide epidemics but is confined to local outbreaks in the immediate vicinity of the common barberry. In some cases only a portion of the grain nearest the bush is damaged, while in others the rust may spread over an area of 50 or more square miles. The damage is always most severe nearest the rust-spreading barberry.

Whenever stem rust has caused serious damage to small-grain crops in Indiana, common barberries have been found spreading the rust. When the offending barberries have been destroyed, severe stem-rust losses have not occurred in these areas in the succeeding years. This shows the value of barberry eradication as a means of controlling stem rust in

Indiana and is one of the most reassuring accomplishments of the campaign. Barberry eradication has more than paid its way in Indiana, by the control of local epidemics during the last eleven years.

Difficulties of Survey and Eradication

The complete eradication of the common barberry from Indiana is a difficult task. This job is not nearly complete. Years will have passed before the State can be pronounced entirely free from these rust-spreading bushes. For more than 100 years barberries have been planted on Indiana home sites, many of which are now abandoned. Weeds, shrubbery, and trees hide many bushes from view, so that an extremely careful survey is necessary. The difficulty is increased many fold by the fact that many bushes which have sprung from seeds scattered by birds and other agencies are often in almost inaccessible places and in many instances they are completely hidden by the surrounding vegetation. Frequently barberry seeds fail to germinate for three or four years, or as many as seven or more years, and after germination several years must elapse before the seedlings are big enough to be easily found.

Probably the biggest problem of the campaign is the thorough clean-up of numerous areas of escaped bushes and seedlings which have been found. A midsized common barberry produces approximately 23,000 seeds each year. A large proportion of these seeds are viable. Seeds from the thousands of old fruiting barberries have been scattered by birds to adjacent groves and orchards, fence rows, brushy pastures, thickets, stream banks, and woodlands of every type. Bushes have been found growing in the crevices of precipitous cliffs, in abandoned stone quarries, in dense thickets of wild currants, gooseberries, and plums, under tangled arbors of clematis, wild grapes, and poison ivy, among second-growth timber, and in marshes and swamps. There seems to be no situation except deep water where barberries will not grow. Because of the difficulty of eradication under these conditions, the clean-up of the areas of escaped bushes is extremely slow.

An effort was made in 1928 to find and destroy every escaped barberry in the areas being surveyed. Foot-by-foot surveys were carried on in all such areas of escaped bushes. The survey in each area is extended at least two miles beyond the limits of the last escaped bush or seedling in order to insure that the outer limits of the area have been reached.

Other Cereal Rusts

There are several different kinds of rusts on grains. Orange leaf rust of wheat and crown rust of oats, as well as black stem rust of grains, are common in Indiana. These rusts are often confused be-

cause their summer or red-spore stages are similar in appearance. Only black stem rust is spread by the common barberry. There is no relation between leaf rusts and common barberry. Crown rust of oats is spread by a few varieties of buckthorn. Orange leaf rust of wheat may be controlled by using resistant varieties of wheat. Experiments are now in progress by the Department of Botany at the Purdue University Agricultural Experiment Station, in cooperation with the United States Department of Agriculture, to determine which varieties are the most resistant.

Summary

Since the beginning of the campaign in Indiana, a preliminary survey has been made of the entire State, six counties have been second-surveyed, and all counties have received at least one resurvey. In the State 200,196 bushes have been found on 5,220 properties. Educational materials have been sent to all universities, colleges, normal schools, high schools, and to the teachers of the four upper grades in the elementary schools of the State. All the county superintendents of public instruction in the State have been personally interviewed by the State Leader, and their cooperation has been secured. Demonstrations have been placed annually at the Indiana State Fair, four demonstrations placed at the International Grain and Hay Show at Chicago, and a series of five colored window displays designed, which bring out the important points of the work in such a way so as to be readily understood by the public.

During the calendar year 1928, 2,724 bushes were found on 135 properties. Twenty-one field assistants were engaged in the second survey of Clinton and Howard Counties and in the eradication of escaped bushes in Lake, Allen, Wabash, Rush, Henry, and Dekalb Counties. Educational materials were sent to all universities, colleges, normal schools, and high schools of the State, and to the elementary schools in the twenty-six southern counties. A demonstration was placed at the Indiana State Fair, one at the International Grain and Hay Show at Chicago, the colored window display series designed and the first of the series was used in the communities being worked, and the press was kept informed as to the progress of the work during the year.

Conclusion

It is definitely known that the common barberry spreads stem rust. Therefore, every barberry bush left growing in the community is a menace to the small-grain crops. The successful completion of the barberry eradication campaign in Indiana will be possible only through the cooperation of every citizen, careful and persistent work in the field, and a definite educational program covering a period of many years. It is impossible to set a definite date when all activities must be completed. We must stay on the job and consecrate ourselves to the task until the last bush has been eradicated, regardless of how many years it may take.